Water Quality Certification
(33 U.S.C. §1341)

In the matter of: Central Vermont Public Service Corporation
77 Grove Street
Rutland, VT 05701

APPLICATION FOR SILVER LAKE HYDROELECTRIC PROJECT

The Vermont Department of Environmental Conservation (the Department) has reviewed a water quality certification application dated December 7, 2007 and filed by the Central Vermont Public Service Corporation (CVPS or the applicant) for the Silver Lake Hydroelectric Project. The supporting documentation for the application includes applicant's Federal Energy Regulatory Commission (FERC) initial license application, filed with FERC under a cover letter dated May 6, 1994 and amended by letter dated April 18, 1995, and two FERC Additional Information Request (AIR) responses, dated February 1995 and February 1996.

The current application is subject to review under the Vermont Water Quality Standards adopted by the Water Resources Board on January 25, 2006 (Standards). Standards became effective on February 9, 2006 (Standards, Section 1-01. *Applicability and Definitions*).

The Department held a public hearing on November 24, 2008 under the rules governing certification and received testimony during the hearing and, as written filings, until November 25, 2008.

The Department, based on the application and record before it, makes the following findings and conclusions.

Findings

I. Background and General Setting

1. By order dated September 29, 1988, FERC issued a finding of jurisdiction under the Federal Power Act for the Silver Lake Hydroelectric Project and ordered the applicant to file a license application within 18 months. The applicant appealed the federal decision, which was upheld on subsequent review. The applicant filed its application for an initial license on May 6, 1994.

2. The Silver Lake Hydroelectric Project is comprised of the Sugar Hill Reservoir on Sucker Brook in the town of Goshen; a downstream diversion dam that shunts water to Silver Lake; the dam and penstock headworks on Silver Lake in the town of Leicester; and the powerhouse located adjacent to Vermont Route 53 in the town of Salisbury. The powerhouse discharges back into Sucker Brook approximately 450 yards upstream of where it enters Lake Dunmore. The diversion dam, penstock and surge tank, and the powerhouse were constructed by the Hortonia Power Company in 1916-17. Recognizing the need for a storage reservoir to provide

more reliable generation, the Hortonia Power Company acquired more lands and constructed Goshen Dam in 1922-23, creating Sugar Hill Reservoir. The applicant subsequently acquired the assets of the Hortonia Power Company, and in 1932-33 raised the dam from 40 feet to 60 feet and lengthened it from 450 feet to 855 feet.

3. The project, much of which is located within the Green Mountain National Forest, utilizes water draining from a land area of 10.2 square miles, including the 9.6 square miles of drainage upstream of the diversion dam and the 0.6 square mile of drainage that flows into Silver Lake itself. Of the 9.6 square miles of drainage area above the diversion dam, a total of 4.5 square miles is in the Dutton Brook tributary watershed.

4. Sucker Brook is the main tributary of Lake Dunmore, comprising 13.5 square miles of the lake's total 20.4 square mile watershed. Lake Dunmore is the source of the Leicester River, a tributary of Otter Creek. The applicant also manages the outlet of Lake Dunmore as part of its unlicensed Salisbury Project.

II. Project and Civil Works

Goshen Dam (Sugar Hill Reservoir) - Sucker Brook

5. Goshen Dam, situated about three miles northeast of Silver Lake and 4.5 miles upstream of Lake Dunmore, is an earth fill structure with a crest elevation of 1777 feet msl[1]. The reservoir is oriented north-south, with the dam at the northerly end. An uncontrolled emergency spillway, 150 feet long and set about six feet below the dam crest, is located on the eastern end of the dam.[2]

6. The dam outlet is located near mid-dam. At the entrance is a wooden trashrack, with 3-inch clear spacing, and a concrete gate, which is inclined at a 30° angle from the vertical and normally maintained in the open position. The outlet is a 4-foot square, 232-foot long reinforced concrete conduit with an inlet invert of 1720 feet msl. Discharges through the conduit are controlled by a nest of five gate valves of varying sizes; these valves are manually adjusted and have a total capacity of about 70 cfs at full pond. At the lower end of the conduit is a baffled outlet structure designed to dissipate energy, prevent winter freezing, and provide reaeration.

7. At the time of the original application, the reservoir was normally maintained within a range of elevation 1763 to 1766 feet msl during the summer. This is about 5 to 8 feet below the emergency spillway crest. At that elevation, the reservoir has an average surface area of about 61 acres. In recent years, an additional two feet of storage (elevation 1761 to 1763 feet msl) has

[1] Crest elevation based on letter from Harriet King, Esq., representing CVPS, to Jeffrey Cueto, Department, November 21, 2008.

[2] The Agency had previously noted discrepancies in the elevations used at Goshen Dam. CVPS, by letter dated December 4, 1998, provided the Agency with the results of a survey done in 1995, the results of which were used to correct the elevations for the emergency spillway crest (previously 1768 feet msl, corrected to 1770.7 feet msl north and 1770.9 feet msl south and the reservoir stage marks on the headgate chain gage (55 foot stage = 1770.5 feet msl).

been utilized for hydroelectric generation (telecommunication between the Agency and CVPS, October 16, 2008). The reservoir morphological information is summarized in the following table.

Table 1. Sugar Hill Reservoir Morphological Information

Reservoir Elevation (feet msl)	Approx. Maximum Depth (ft.)	Surface Area (acres)	Storage Volume (acre-feet)
1770.8 emergency spillway crest	55	70	1,520
1766 normal high summer operating level	50	64	1,200
1761 normal low summer operating level	45	59	900
1758 proposed maximum drawdown to provide conservation flows	42	55	750
1753	37	38	520
1743	27	20	200
1732 historic operating rule max. winter low	16	4	40
1720 outlet invert	4	0+	0+

Note: Estimates made by staff based on Figure E-2, *Bathymetric Map of Sugar Hill Reservoir*, license application, vol. I, and storage table provided by CVPS, August 10, 1995; values differ somewhat from those used in the license application. Elevations have been corrected (+3 feet) based on the 1995 survey; estimates of areas and volumes may be slightly off since the bathymetric map was from 1957 and may or may not have used a correct vertical control. The approximate maximum depth corresponds to the reservoir stage markings on the headgate chain gage (Stage 55 feet = 1770.5 feet msl).

8. Goshen Dam is used for flow regulation and enhancement of downstream power production. It does not incorporate generating facilities.

Diversion Dam - Sucker Brook

9. The Sucker Brook diversion dam is located 2.5 miles downstream of Goshen Dam. Sucker Brook and Dutton Brook presently join just upstream of the dam and are diverted via a 42-inch diameter conduit to Silver Lake. Dutton Brook was apparently channelized to divert it to Sucker Brook upstream of the intake; the remnant natural channel of Dutton Brook continues downstream of the diversion dam. The diversion dam conduit discharges into a stepped concrete flume about 460 feet in length and located at the northeast shore of Silver Lake.

10. The dam has an east-west orientation, with the impoundment on the south side. It is an earth fill structure, 725 feet in length with a 60-foot concrete spillway section on the east end. The concrete spillway is a 1- to 2-foot cap on bedrock, with a crest elevation of 1306 feet msl. The intake for the diversion conduit is located on the west end of the structure; flows into the conduit can be regulated using a 3 foot by 4 foot timber headgate. The gate is normally used only to shut down flows to the conduit for maintenance purposes. The intake is served by a trashrack with 4-inch clear spacing between bars.

11. During normal flows, the dam does not impound water. The stream is about 18 feet below the spillway crest on the upstream side of the structure. During high flows, the dam impounds an area of up to about two acres before spillage occurs. This occurs for about two or three weeks in the spring and during two or three events for one or two days as a result of rainfall (Response to AIR No. 2, *Additional Information Second Set, Silver Lake Project No. 11478*, CVPS, February 1996).

Silver Lake Dam - Unnamed tributary of Sucker Brook

12. Silver Lake is a natural lake with a water level raised by the project dam. The lake is approximately one mile long and is 1,500 feet wide at its widest point. The lake provides the source of water for generation at a gross operating head of 676 feet.

13. The dam on Silver Lake is a buttressed concrete wall with earth fill on either side. It has a maximum height of about 30 feet. The dam has a total length of 284 feet, including the 8-foot unregulated spillway and the 18-foot intake structure. The spillway crest elevation is set at 1251 feet msl, or eight feet below the dam crest; the applicant historically maintained the lake level at a maximum pool elevation of 1250 feet msl, or one foot below the spillway crest. To reduce shoreline erosion potential, the applicant recently reduced its maximum operating level to 1247.5 feet msl from April 1 through December 31.

14. The penstock intake extends into the lake about 35 feet upstream from the dam's gatehouse (Engineering Drawing: *Silver Lake Excavation of Leaf Matter and Headgate Repair, August - September 1997*, CVPS, from 1962 base plan). The entrance contains a trashrack with 1.75-inch clear spacing between the bars, and a second trashrack is set inside of the outlet structure. The outlet structure includes a headgate that is electrically operated with local controls or remotely closed from the applicant's control center in Rutland. The outlet also includes a low-level wastegate.

15. A 5,221-foot penstock connects the lake to the powerhouse. It begins as a partially buried 48-inch diameter fiberglass pipe extending approximately 2,681 feet, and connects to a buried 48-

inch diameter welded steel pipe which extends about 140 feet to a surge tank. At the surge tank, the penstock transitions to a 36-inch welded steel pipe and extends approximately 2,400 feet to the powerhouse. (Letter from Harriet King, Esq., representing CVPS, to Jeffrey Cueto, Department, November 21, 2008)

16. At the former normal maximum pond level (one foot below the spillway crest), the lake has a surface area of 110 acres and a gross storage volume estimated to be 3,120 acre-feet. The useable storage volume for generation was 1,550 acre-feet. The lake's morphological information is summarized in the following table.

Table 2. Silver Lake Morphological Information

Lake Elevation (feet msl)	Surface Area (acres)	Storage Volume (acre-feet)
1259 dam crest		4,800
1250 former normal pond	110	3,120
1247.5 current normal pond		
1239.5 normal max. drawdown		

17. The project's one-story powerhouse contains a single horizontal Pelton wheel turbine with a generator rated at 2,200 kW and a hydraulic capacity of approximately 60 cfs. The net head at the powerhouse is estimated at 645 feet, reflecting a loss of 31 feet from the static head. The powerhouse discharges into a 450-foot long tailrace channel. At the lower end of the channel before it enters Sucker Brook, a sloped rack was installed in August 1992 to prevent fish from entering when the channel is carrying generation flows and then becoming stranded in the tailrace when the station shuts down.

18. The plant produces an average annual output of 6,150,100 kWh based on the 20-year record ending in 2007. (Letter from Harriet King, Esq., representing CVPS, to Jeffrey Cueto, Department, November 21, 2008)

III. River Hydrology and Streamflow Regulation

19. The Silver Lake Project is designed to capture the majority of annual runoff from a 10.2 square mile total drainage–the 9.6 square miles of Sucker Brook watershed above the diversion dam combined at Silver Lake with the lake's direct drainage of 0.6 square mile. Both Sugar Hill Reservoir and Silver Lake are drawn in the winter to accommodate spring runoff. This reduces the loss of water to the system enabling the applicant to more reliably generate electricity throughout the year.

20. Use of flow for generation follows a weekly demand cycle providing peak power generation; the station does not normally operate on weekends. Typical operation is from 7:00 a.m. through 3:00 p.m. Early week operation may be extended over one or two days in order to reduce operator expenses. (Response to AIR No. 11, February 1995)

21. Flow releases from Sugar Hill Reservoir are managed primarily to augment flows in Sucker Brook for diversion to Silver Lake under the power generation schedule in place at the time; the applicant maintains a continuous conservation flow below the dam at all times. No flows are maintained in the natural stream channels below the diversion dam and below Silver Lake. The reach below the diversion dam contains flow frequently enough that the natural channel is well defined; 3,200 feet downstream of the dam, the first large tributary, the North Branch, enters Sucker Brook. The natural channel below Silver Lake dam only receives local drainage and a small amount of gate leakage at the dam; the channel is poorly defined as a result. A leakage flow of 0.25 cfs was measured in October 1994 (Response to AIR No. 4, *Additional Information, Silver Lake Project No. 11478*, CVPS, February 1995). Silver Lake is 3,600 feet upstream of Sucker Brook.

22. There is no recorded flow data for Sucker Brook. To complete analyses related to project licensing, the applicant transposed data from a U.S. Geological Survey gaging station on Ayers Brook in Randolph.

Sugar Hill Reservoir

23. Sugar Hill Reservoir, which is on Sucker Brook, captures runoff from 2.6 square miles of the brook's watershed. For seasonal storage, Sugar Hill Reservoir is normally drawn about 27 feet beginning in September ending in March. The completion of the drawdown is timed to assure capture of spring runoff. The maximum drawdown level is set based on the water content of the snowpack and consequently can vary by about ten feet (total drawdown between 24 and 34 feet). Refill is complete by June. (*Application for Initial License for Major Water Power Project - 5 Megawatts or Less - Silver Lake Hydroelectric Project*, May 1994, Volume I, p. A-8 and Fig. 1)

24. Releases of up to 70 cfs from Sugar Hill Reservoir are managed using the five gate valves at the outlet. Valve settings can remain unchanged for weeks at a time. Care is taken to prevent a surcharge of the spillway even if it necessitates a release of water that is not needed for downstream generation at the time. Data provided for calendar year 1989 suggests that discharges in excess of about 17 cfs are relatively uncommon; there was a one-week release of about 31 cfs in early May of that year (*Application for Initial License for Major Water Power Project - 5 Megawatts or Less - Silver Lake Hydroelectric Project*, May 1994, Volume I, Fig. 1a, p. A-10)[1].

[1]Response to AIR No. 6 (*Additional Information Second Set, Silver Lake Project No. 11478*, CVPS, February 1996) provides a data set from 1985 through 1994 that is consistent with this finding; however, the May 1989 flow recorded in that data set is 23.3 cfs instead of 31 cfs. In 1987, there were 2-day releases of 68 cfs in April and June, with all five valves full open.

25. In response to AIR No. 6 (*Additional Information Second Set, Silver Lake Project No. 11478*, CVPS, February 1996), CVPS provided ten years of operating records, 1985-94, for Sugar Hill Reservoir. The records show the daily settings on the five valves (2-6" valves, 2-8" valves, and one 10" valve) and corresponding total outflow estimates. The reservoir levels are not provided. Although the reservoir elevations are highly variable, the estimated valve discharges are shown as fixed values instead of estimated based on a functional relationship to reservoir elevation. The maximum annual daily releases varied substantially, based on CVPS's estimates, between 17 cfs in January 1991 and November 1992 and 68 cfs in April and June 1987.

26. Operations personnel normally travel to the dam once a week and adjust the outflow as necessary to maintain consistency with the rule curves (stages shown; stage of zero = 1715.5 feet msl):

June – August	48.5 feet ±1.5 feet (recently modified to 47.5 feet ±2.5 feet)
September – December	Decreasing to 42.5 feet ±1.5 feet
January – February	Decreasing to 21 feet ±5 feet depending on snowpack
March – May	Increasing to summer level

Typically, the reservoir level does not change more than one foot in a week. Spring is the exception when levels can decline two feet per week before runoff and rise as much as 20 feet in a week. (Response to AIR No. 1, *Additional Information, Silver Lake Project No. 11478*, CVPS, February 1995)

27. The license application indicates that the applicant voluntarily releases a continuous minimum flow, estimated as 2.5 cfs, at all times from Goshen Dam, even when natural inflows from the 2.6 square mile contributing watershed decline below the fixed discharge. The 1989 data supplied by the applicant indicated that the reservoir was drawn as much as six feet to maintain 2.5-3.0 cfs below the dam during what was a relatively wet summer.

28. To provide the continuous minimum flow below Goshen Dam, CVPS previously maintained one 6-inch value open four full turns. CVPS recently changed its practice to reducing the valve opening to two full turns when the reservoir drops to elevation 1761 feet msl. There is no record as to how the valve discharge was originally estimated. On October 24 and November 11, 2008, the applicant's consultant measured flows below the valve house with a 6-inch valve open four turns (reservoir at elevation 1765.9 feet msl). The discharge measurements averaged about 2.5 cfs, confirming the prior estimate. A V-notch weir was installed at the same time to enable the operator to adjust any valve or combination of valves to release the 2.5 cfs discharge at any reservoir elevation.

Applicant proposal for relicensing:

29. The applicant provided the Department with a proposed operating rule curve for the reservoir during a field evaluation of ecological impacts on June 3, 2002. The applicant proposes, as described above, to maintain the same maximum normal summer pool at Stage 50 feet

(elevation 1765.5 feet msl), but to increase the maximum summer drawdown to five feet from the current three feet. Under the 2002 rule curve, the winter drawdown would start much later, around the beginning of February, rather than beginning in fall as early as September; by letter dated November 21, 2008, CVPS provided a new rule curve with the start of the winter drawdown shifted to January 1 (Letter from Harriet King, Esq., representing CVPS, to Jeffrey Cueto, Department, November 21, 2008). The maximum limit of the winter drawdown would be raised to Stage 32 feet (elevation 1747.5 feet msl), with the annual maximum varying between stages 32 feet and 42 feet. Under the new rule curve, the maximum drawdown is expected to be reached about the same time, around late February or early March, but the subsequent spring recovery from snowmelt runoff would be a bit earlier than historic conditions, mid-April instead of sometime in May.

30. A conservation flow of 2.5 cfs will be provided year around. The flow would be guaranteed from storage. During the summer period, up to an additional three feet of drawdown would be used to guarantee the flow (down to Stage 42 feet).

Sucker Brook diversion dam

31. Except for extreme high flows, all water from Dutton Brook and Sucker Brook is diverted to Silver Lake via the pipe conduit. According to the applicant's response to AIR No. 4, there is no leakage discharged to the natural downstream channel under normal conditions (*Additional Information, Silver Lake Project No. 11478*, CVPS, February 1995).

Applicant proposal for relicensing:

32. To provide spillage at the diversion dam, the applicant originally proposed to install flashboards on the spillway crest, up to 3.0 feet in height and to create an impoundment behind the flashboards by covering the lower portion of the intake trashracks with plywood to raise the pond level from its current elevation of 1288 feet msl to 1309 feet msl. Water will not be impounded at the diversion dam. Instead the diversion conduit will be tapped a short distance below the dam to discharge into the left channel.

33. The applicant proposes to maintain a minimum flow of 2.5 cfs in Sucker Brook below the diversion dam as long as the guaranteed flows are being released at Goshen Dam. When inflows and water levels decline at Sugar Hill Reservoir and CVPS is releasing reservoir inflows instead of the 2.5 cfs guaranteed flow, CVPS will estimate the flow at the diversion dam by multiplying the reservoir release by four, the watershed area proportion (9.6:2.6). If the resulting estimate is less than 2.5 cfs, the conduit tap discharge will be adjusted to divert all flows into the bypass reach below the diversion dam.

Silver Lake

34. The lake receives flows from its natural 0.6 square mile watershed, supplemented by the Sucker Brook diversion.

35. Silver Lake is normally held relatively stable during the summer and fall recreational period, and then drawn about 7.5 feet from January through March. It rapidly fills during spring runoff.

Sugar Hill Reservoir controls about a quarter of the watershed contributing flow to Silver Lake. Occasionally, the lake is not completely refilled until late June.

36. The Rutland control center personnel monitor lake levels remotely and determine the hydroelectric station operating schedule considering established lake level operating rules. Historically, the rules were as follows:

June	Elevation 1246 – 1249 feet msl
July – August	Elevation 1247 – 1249 feet msl
September – December	Elevation 1246 – 1249 feet msl
January – March	Decreasing to 1241 feet +/- 1.5 feet depending on snowpack
April – May	Increasing to summer level

Typically, the lake level does not change more than one foot in a week. The hydraulic capacity of the diversion conduit and the penstock limit maximum water level increases to less than one foot per day.

Starting in 1995, CVPS modified the summer operation in order to control shoreline erosion problems experienced at the U.S. Forest Service beach at the north end of the lake. The normal maximum pool was reduced to elevation 1247.5 feet msl. The lake is now maintained between 1245.0 feet and 1247.5 feet msl from June through December.

(Response to AIR No. 1, *Additional Information, Silver Lake Project No. 11478,* CVPS, February 1995)

37. All discharges from the lake are controlled through the penstock at a fixed rate of 60 cfs for generation. Since the discharge is at a fixed rate and inflows vary, the lake level fluctuates slightly during the summer; however, the applicant balances generation and inflows to maintain a relatively stable lake level for recreational use. The applicant provided turbine rating curves in response to AIR No. 10 (*Additional Information Second Set, Silver Lake Project No. 11478*, CVPS, February 1996).

Applicant proposal for relicensing:

38. The applicant proposes to continue its current operating regime at Silver Lake, except the operating range for the period June through December would be reduced to 2.0 feet, with 1247.5 feet msl remaining as the normal maximum lake level.

Sucker Brook below the powerhouse tailrace

39. Because generation from Silver Lake is not continuous and is at a high fixed discharge, instream flows vary substantially depending on whether or not the station is on line. The changes in flow are rapid. The change in flow is made more substantial by the fact that the project removes

about three quarters of the natural streamflow from Sucker Brook before it reaches the lower reach.

Applicant proposal for relicensing:

40. During the spring, the hydroelectric station would be operated using a special protocol to prevent dewatering of smelt eggs. The applicant also proposes to employ ramping year around when transitioning from generation to storage.

IV. Standards Designation

41. The applicable 2006 Vermont Water Quality Standards (Standards) were promulgated by the Vermont Water Resources Board pursuant to 10 V.S.A., Chapter 47, Water Pollution Control. Section 1252 of the chapter provides for the classification of State waters as either Class A or Class B and authorizes the adoption of standards of water quality to achieve the purpose of classification.

42. Sucker Brook and its tributaries found below 2500 feet in elevation have been designated by the Vermont Water Resources Board as Class B waters. The Water Resources Board has also designated all waterbodies in the drainage as cold water fish habitat.

43. Class B waters are managed to achieve and maintain a high level of quality compatible with certain beneficial values and uses. Values are high quality habitat for aquatic biota, fish and wildlife and a water quality that consistently exhibits good aesthetic value; uses are public water supply with filtration and disinfection, irrigation and other agricultural uses, swimming, and recreation. (Standards, Section 3-04(A) *Class B Waters: Management Objectives*)

44. All waters at the Project are designated coldwater fish habitat for the protection and management of fisheries. (Standards, Section 3-05. *Fish Habitat Designation*)

45. The dissolved oxygen standard for cold water fish habitat streams is 6 mg/l and 70 percent saturation unless higher concentrations are imposed for areas that serve as salmonid spawning or nursery areas important to the establishment or maintenance of the fishery resource. (Standards, Section 3-04(B)(2) *Water Quality Criteria for Class B waters: Dissolved Oxygen*) The temperature standard limits increases to 1.0 deg F from ambient conditions, or background. (Standards, Section 3-01(B)(1) *General Criteria: Temperature*) The turbidity standard is 10 NTU. (Standards, Section 3-04(B)(1) *Water Quality Criteria for Class B waters: Turbidity*)

46. Under the Class B criterion for aquatic biota, wildlife and aquatic habitat, the Standards require "[n]o change from the reference condition that would prevent the full support of aquatic biota, wildlife, or aquatic habitat uses. Biological integrity is maintained and all expected functional groups are present in a high quality habitat. All life-cycle functions, including overwintering and reproductive requirements are maintained and protected." As the waters at the Project have not been assigned a water management type, the criterion is "no change from background conditions that would have an undue adverse effect on the composition of the aquatic biota, the physical or chemical nature of the substrate or the species composition or propagation of

fishes." (Standards, Section 3-04(B)(4) *Water Quality Criteria for Class B Waters: Aquatic Biota, Wildlife and Aquatic Habitat*)

47. The Hydrology Policy requires that "[t]he proper management of water resources now and for the future requires careful consideration of the interruption of the natural flow regime and the fluctuation of water levels resulting from the construction of new, and the operation of existing, dams, diversions, and other control structures." (Standards, Section 1-02(E)(1) *General Policy: Hydrology Policy*) For Class B waters, "[a]ny change from the natural flow regime shall provide for maintenance of flow characteristics that ensure the full support of uses and comply with the applicable water quality criteria." (Standards, Section 3-01(C)(1) *Hydrology Criteria: Streamflow Protection*)

48. The Anti-Degradation Policy provides for protection of existing uses and high quality waters. (Standards, Section 1-03. *Anti-Degradation Policy*) Based on the analysis and conditions set forth below, the Department finds that there will be no new or increased activity that will significantly affect water quality, but rather the proposed operation will improve water quality in the overall project area. Therefore, no additional analysis pursuant to Section 1-03 is warranted.

Present status:

49. On March 1, 2007, the USEPA approved a list of waters considered to be impaired based on water quality monitoring efforts. The list was submitted by the Department under Section 303(d) of the Federal Clean Water Act. The quarter-mile segment below Goshen Dam was listed as impaired for aquatic life support due to low dissolved oxygen concentrations caused by a hypolimnetic withdrawal from the reservoir. The updated list of waters approved by USEPA on September 24, 2008 does not list the segment below Goshen Dam.

50. The Department also issued a six-part list, *List of Priority Surface Waters Outside the Scope of the Clean Water Act Section 303(d)* in 2008. Part F lists those surface waters where water quality or habitat is being impacted by flow regulation. All project affected waters are listed as not in full support of aquatic life due to the Project's flow regulation. The stream below Silver Lake and the 2.5 miles of Sucker Brook below Goshen Dam are listed as in non-support for all uses due to flow regulation.

Water Chemistry

51. The watershed of Sucker Brook is predominantly forested with very sparse residential development that is located in the upper portion of the Dutton Brook watershed south of Sugar Hill Reservoir. Water quality threats are, therefore, limited.

52. The Department has identified two major issues related to physical/chemical water quality: the influence of reservoir stratification on the dissolved oxygen regime of Sucker Brook and the influence of artificial low flows on the brook's dissolved oxygen and temperature regimes.

Impact of lake/reservoir stratification on downstream water quality:

53. Thermal stratification of reservoirs and lakes during the summer can create oxygen-depleted conditions in their deeper zones. Unlike natural lakes, water from some reservoirs and lakes with artificial outlets is often discharged from low-level outlets instead of the lake surface, passing the low dissolved oxygen conditions downstream.

54. Sampling efforts were undertaken by the applicant in the summers of 1991 and 1992 within Sugar Hill Reservoir; directly downstream of Goshen Dam and at distances downstream of 200 feet, 400 feet, 600 feet, and 5,000 feet (at the bridge crossing of Forest Road #32); at the discharge point of the diversion conduit into Silver Lake; at the tailrace discharge of the powerhouse; and in Sucker Brook just upstream of tailrace confluence and 1/4 mile below the tailwater confluence.

Sugar Hill Reservoir

55. Dissolved oxygen profiles completed on July 16, 1991 display stratification characteristics. Near the reservoir outlet, the lowermost ten feet of water was measured at less than 20% oxygen saturation (*Application for Initial License for Major Water Power Project - 5 Megawatts or Less - Silver Lake Hydroelectric Project*, May 1994, Volume I, p. E1-16). The license application does not contain the specific data set discussed in the narrative, so it is not clear precisely what the spatial location of the sampling data is relative to the outlet. According to Exhibit F, sheets 1 and 2 of the license application, the deepest area of the reservoir bed is at about elevation 1714 feet msl, assuming the area has not been filled by sedimentation, and the outlet intake is between elevation 1717 and 1721 feet msl. It is, therefore, reasonable to assume that the outlet entrains oxygen-depleted water.

56. The baffle system at the discharge end of the outlet raises the dissolved oxygen concentration of the water. Data was collected from mid-July through August 1992 to supplement data collected on June 14 and July 26, 1991 data in evaluating how effective the baffle system is in protecting downstream water quality. Sampling completed on August 28, 1992 included several sampling stations in the 600-foot segment below the Goshen Dam outlet to examine recovery due to reaeration by the natural stream channel. The baffle system was generally able to bring the water close to or above minimum dissolved oxygen standards of 6 mg/l and 70% saturation. The lowest dissolved oxygen concentration of 5.5 mg/l (59% saturation at 15.6 deg C) was recorded on July 26, 1991. The recovery sampling completed on August 28, 1992 indicated that the baffle system brought the dissolved oxygen level up to 5.8 mg/l and 62% saturation and that full standards were achieved within 400 feet of the outlet (6.7 mg/l and 71% saturation); saturation was attained by the time Forest Road #32 was reached 5,000 feet downstream. Reaeration rates immediately below the dam are somewhat limited by the relatively shallow gradient of Sucker Brook through this reach.

57. In its response to AIR No. 9 (*Additional Information Second Set, Silver Lake Project No. 11478*, CVPS, February 1996), the applicant proposes to conduct a post-licensing water quality study to determine if stratification problems persist after the new reservoir water level management rule is implemented. If a dissolved oxygen problem does occur, a reaeration baffle would be installed and tested to determine if dissolved oxygen standards can be met using the baffle.

Silver Lake

58. Sampling completed on July 16, 1991 exhibited a thermocline beginning at a depth of 14 feet. The total depth sounded was 75 feet. Below the 14-foot depth, the temperature ranged from 6 to 13 deg C and the percent saturation from 71 to 100%. The sampling station location was not provided. The penstock intake is at a depth of about 13 to 21 feet, relative to elevation 1250 feet msl, the normal summer pool (Engineering Drawing: *Silver Lake Excavation of Leaf Matter and Headgate Repair, August -September 1997*, CVPS, from 1962 base plan). This is at a substantially shallower depth than the condition existing at Sugar Hill Reservoir, reducing the risk of entrainment of anoxic water.

59. Although substandard conditions due to stratification have not been identified in Silver Lake, the available sampling is limited to the single day's data. The data collected at the station tailrace, however, display relatively high temperatures and dissolved oxygen concentrations, suggesting that there is no hypolimnetic discharge of oxygen depleted water.

60. The data indicates that the tailrace discharge causes a significant increase in the water temperature of Sucker Brook. The tailrace station varied in temperature from 17.1 to 25.2 deg C, while the upstream Sucker Brook water temperature varied from 11.0 to 18.4 deg C. The effective change in brook temperature from above to below the tailrace was 4.1 to 6.7 deg C. This probably reflects the higher water temperatures in the upper zone of Silver Lake and possibly some frictional heating of the water as it moves through the penstock. As the sampling was completed under pre-dawn conditions, radiant heating of the exposed penstock would not be a factor, although some conductive heat transfer may be occurring.

Impact of artificial low flows on stream temperatures:

61. Under current conditions, leakage flow conditions at the diversion dam create isolated pools of water in the reach between the dam and the North Branch. It is likely that water temperatures approach air temperatures under such conditions, further reducing the brook's capability to support fish and other aquatic organisms. Below Goshen Dam, the low-level release of cold water at a continuous higher rate does not result in a comparable issue above the diversion dam. No water quality monitoring was completed below the diversion dam, given that flows are to be restored to this reach and flow and temperature conditions substantially improved.

V. Aquatic Biota and Habitat

62. Class B waters are managed to provide high quality habitat for aquatic biota (Standards, Section 3-04(A) *Class B Waters: Management Objectives*). Aquatic biota are defined as "organisms that spend all or part of their life cycle in or on the water." (Standards, Section 1-01(B) *Definitions*) Included, for example, are fish, aquatic insects, amphibians and some reptiles, such as turtles.

63. The Sucker Brook watershed supports a fish community comprised of cold and warmwater fisheries, native and stocked, and several non-game fish species.

Sugar Hill Reservoir

64. Sugar Hill Reservoir is managed by the Agency as a put-and-take brook trout fishery. Annual stocking rates between 1991 and 1995 varied from 1,800 to 4,500 brook trout per year (letter from David R. Callum, District Fisheries Biologist, Vermont Department of Fish and Wildlife to Bruce M. Peacock, CVPS, September 9, 1994). In 2008, 1,800 brook trout were stocked. The historic winter drawdown regime has precluded management for a winter holdover of trout and natural reproduction. Reducing the extent of the winter drawdown should improve survival and winter holdover of trout.

65. Other fish species, such as rock bass, sunfish species, and minnows, are presently supported in Sugar Hill Reservoir. Severe drawdowns are also believed to have significantly limited aquatic vegetation production and detrimentally affected these warmwater fish species. Aquatic vegetation provides many fish with spawning habitat and protection from predation and enhances production of fish prey items. Reducing the winter drawdown should improve survival of fish and other aquatic life in the reservoir.

66. The reservoir is on the Priority Waters list as not supporting aquatic life. The Department attributes this to water level fluctuations. The reservoir substrate would support a good littoral zone community of plants, macroinvertebrates, and fish, but the exposure limits plant growth and year around utilization by macroinvertebrates and fish. Based on a survey by the Department in 2002, the biological indices for both the main reservoir and the south bay are significantly lower than those for reference waterbodies in its category (small, low alkalinity lakes) (*An Evaluation of Sugar Hill Reservoir's Macroinvertebrate Community Integrity*, Vermont Department of Environmental Conservation, December 16, 2002).

67. Fish stocked in Sugar Hill Reservoir and fish that may move into Sugar Hill Reservoir from the upper watershed of Sucker Brook for overwintering habitat are exposed to mortality due to stranding and predation caused by the winter drawdown. The fish population of the watershed above Sugar Hill Reservoir includes brook and brown trout and sculpins. Under the historic operating rule, the maximum annual winter drawdown to as low as 1729 feet msl resulted in a net remaining storage volume as small as 40 acre-feet; relative to the current summer maximum operating level, up to 97% of the reservoir volume was drained during the winter.

Silver Lake

68. Silver Lake is currently managed by the Agency as a stocked brook and rainbow trout fishery. Under the Agency's trout management plan (*The Vermont Management Plan for Brook, Brown and Rainbow Trout*, September 1993), brook and rainbow trout have been stocked at annual rates of 1,000 and 500 fish, respectively, since 1995 (letter from David R. Callum, District Fisheries Biologist, Vermont Department of Fish and Wildlife to Bruce M. Peacock, CVPS, September 9, 1994). In 2008, 1,100 rainbow trout and 1,000 brook trout were stocked. In addition, 12,000 fingerling brook trout were stocked. The lake also supports rainbow smelt, yellow perch, and brown trout. The smelt population is self-sustaining, using the inlet stream and possibly the lake shoreline for spawning. There is some natural reproduction of brook and rainbow trout as well.

69. In order to protect smelt spawning in the Silver Lake inlet, there should be no decrease in the water elevation in Silver Lake during the smelt spawning and incubation period of March 15 through May 15. The seasonal drawdown will typically be completed by late March and the summer level of the reservoir restored by the end of April. Timing will, of course, vary with spring runoff conditions in each year.

Sucker Brook - Goshen Dam to diversion dam

70. The reach between Goshen Dam and the diversion dam is managed as a wild brook and brown trout fishery. The U.S. Forest Service has done fish population work is several streams in the project area. Based on information available at the time of the license application, Sucker Brook below Goshen Dam has a relatively low standing crop of trout when compared to similar area streams. The reason for this condition has not been determined; however, flow regulation and lack of spawning gravels due to the reservoir's effect on bedload transport have been identified as possible factors.

71. Fisheries biologists from the Agency, the U.S. Fish and Wildlife Service, and the U.S. Forest Service completed a visual assessment of habitat conditions at flows of 2.5 cfs and 12 cfs in Fall 1994. The flow of 2.5 cfs was generally found to provide some center-channel habitat for young trout but limited adult habitat due to shallowness and a lack of cover. The flow of 12 cfs was judged excessive.

72. Flow fluctuations caused by operation of the valve system to augment downstream flows by up to about 70 cfs may disrupt downstream habitat and cause mortality.

Sucker Brook - diversion dam to powerhouse tailrace

73. Lack of flow below the diversion dam has eliminated coldwater fisheries management opportunities in the 3,200 foot affected reach down to the North Branch. The North Branch, a perennial stream, contributes some flow to Sucker Brook, providing partially restoration of aquatic habitat. The brook flows about 0.8 mile from the mouth of the North Branch to the Falls of Lana, then another 0.4 mile to the project tailrace.

74. Evaluation of the upper portion of this reach by Agency biologists indicates that the brook, with restored flows, has excellent potential to support healthy, self-sustaining populations of brook and brown trout. The reach below the Falls of Lana, which is a natural impediment to upstream fish movement, to the project tailrace is accessed by landlocked Atlantic salmon from Lake Dunmore. The salmon utilize Sucker Brook for reproduction and rearing habitat.

75. Fisheries biologists from the Agency, the U.S. Fish and Wildlife Service, and the U.S. Forest Service completed a visual assessment of habitat conditions at flows of 1 cfs, 3 cfs, 5 cfs, and 8 cfs, as measured at the dam. A flow of 5 cfs was judged as providing the best habitat conditions and generally provided adequate depth for unimpeded fish movement. The flow provided full circulation of water through the pools, and turbulent reaeration was evident. A flow of 3 cfs was judged to provide a reasonable amount of habitat at some but not all of the sites observed; the wetted width appeared small for the size of the overall channel, but it was a marked improvement over 1 cfs. A supplemental assessment was conducted later focusing on flows of 2 and 3 cfs. Habitat conditions were improved at 3 cfs, in comparison to those at 2 cfs. A flow

regime that decreases the frequency and duration of lower flows is expected to improve fish survival and growth.

Sucker Brook - below-tailrace reach

76. In the spring, the lower reach of Sucker Brook is used by rainbow smelt resident in Lake Dunmore for spawning. Brook and rainbow trout are supported. Juvenile lake trout are also known to move into Sucker Brook from Lake Dunmore to utilize the brook during the spring and fall.

77. The brook is the primary smelt stream for Lake Dunmore and is critical to sustaining its smelt population. The period of smelt spawning and incubation varies for year to year based on climatic conditions, but normally occur sometime between March 15 and May 15. Smelt spawn at night along stream margins. The stream wetted width maintained during smelt spawning and incubation is, therefore, important. Depending on water temperature, the eggs incubate 10 to 30 days.

78. Presently, the project's regulation of flows impairs fisheries and invertebrate habitat in the lower segment of the brook. Since the project operates in a peaking mode, both minimum and maximum flows downstream of the project are aquatic habitat issues, as are the effects of spatial shifts in suitable habitat and the effects of a frequently fluctuating flow regime.

79. The visual assessment of flows continued in this reach for flows of 1 cfs, 3 cfs, 5 cfs, and 8 cfs, as measured at the diversion dam. Flows contributed by the intervening drainage were not measured. The biologists judged a flow of 5 cfs as providing similar habitat conditions to those observed above the Falls of Lana at that same flow. A flow of 3 cfs was judged to provide a reasonable amount of habitat in most but not all sites. Wetted width and habitat was judged to be markedly better at 3 cfs when compared to 1 cfs.

80. The applicant proposed a ramping plan in its response to AIR No. 5 (*Additional Information, Silver Lake Project No. 11478,* CVPS, February 1995). Currently, the station goes from full load to no release over a two-minute period. The applicant proposes to change the rate to stepping down in three, 5-minute intervals. The Agency has recommended that the maximum change in flow over each of the two first steps be specified as no greater than 20 cfs (letter from Jeffrey R. Cueto, Agency to FERC, April 19, 1996).

81. At the time of the license application, the applicant voluntarily operated the powerhouse 24 hours a day during smelt spawning after notification that the smelt run has begun. This 24-hour operation is theoretically effective because the smelt eggs deposited at night are still covered with water on succeeding days and nights until egg hatching occurs. However, the notification system may not have been sufficient to assure that the operation protects the full spawning and incubation period from when the smelt enter the brook until egg incubation is complete. The system relied on an informal arrangement with the Agency District Fisheries Biologist, who subsequently retired. Even with this cooperative arrangement, the specific beginning and end of the smelt period was not always identified.

82. To assure consistent protection of smelt reproduction, the Agency recommended that CVPS consider bracketing the spawning and incubation period using the dates of March 15 to May 15

(letter from Jeffrey R. Cueto, Agency to FERC, April 19, 1996). CVPS responded that, in a dry spring, plant operations could not be maintained during the full period without excessive use of storage in Silver Lake. In a letter dated June 15, 1995 to the Agency and repeated in the response to AIR No. 5, the applicant proposed an alternative operating protocol for the station during the smelt spawning season. This procedure would involve either one of two approaches: 1) 24 hours per day operation similar to the past protocol or 2) operation during the daytime only. The applicant proposed to maintain this protocol for the five weeks after ice out on Lake Dunmore.

83. The Agency accepted the applicant's proposal for 24-hour operation or daytime-only operation during the duration of the spawning and incubation period, given that sustaining artificially high flows may conflict with water level management objectives at Silver Lake. The ice-out trigger and use of a five week period was not accepted, however, because the spawning run can begin before ice out and because five weeks is too short to consistently cover both the spawning run and the incubation period.

84. In 1998, CVPS proposed and started operating under an alternate protocol, outlined in *Monitoring of Smelt Spawning in Sucker Brook to Develop an Operating Protocol for Silver Lake Station, Salisbury, Vermont* (August 24, 1998). Under the protocol, a staff gage has been installed on a nearby bridge, and both water levels and evidence of smelt spawning are monitored beginning the last full week of March. When eggs are first identified, the applicant reduces or suspends nighttime generation in order to force spawning to areas that will not be susceptible to dewatering. Daytime generation is used to control lake storage. CVPS has indicated that this protocol is feasible as it can operate the station over a range of flows from 28 to 63 cfs, although best gate is about 60 cfs (telecommunication between Roderick Wentworth, Vermont Department of Fish and Wildlife and Michael Scarzello, CVPS, November 10, 2005)

85. Based on CVPS data from 1998 to 2004, egg deposition has been observed as early as April 2 and 95% of the hatching has been as late as May 15. The spawning and incubation period has varied in length from 27 to 42 days, averaging 33 days. Older records have shown spawning runs beginning as early as March 8.

86. The Department of Fish and Wildlife supports continued use of the current protocol with several suggested modifications: 1) begin monitoring for smelt use earlier, on March 15; 2) specify the start and end of the night time period for reduced or no generation (suggested sunset to sunrise as tabulated in the Vermont digest of hunting and fishing laws; and 3) installation of water level and water temperature dataloggers in the principal smelt spawning area and comprehensive data reporting to allow refinement of the protocol over time. (Memorandum from Roderick Wentworth, Vermont Department of Fish and Wildlife to Jeffrey Cueto, Department, January 10, 2006)

VII. Wildlife and Wetlands

87. **Sugar Hill Reservoir.** Under current conditions a wetland has become established at the south bay where Sucker Brook enters the reservoir. The wetland is about 3.5 acres in size and is dominated by low-diversity annual plant species.

88. The extensive drawdowns at Sugar Hill Reservoir, both during the winter and during the growing season, are a major factor in preventing the establishment of beneficial wetland plant communities that would otherwise become established along the shoreline margins, including the shallower bay where Sucker Brook enters the reservoir.

89. Existing winter drawdowns adversely affect overwintering of some aquatic mammals and reptiles and amphibians which seasonally use the shallow mud areas. Current operation leaves animals vulnerable to freezing and predation as the water level decreases through the fall/winter period. Given the current operating regime, it is unlikely that reptiles or amphibians successfully overwinter in Sugar Hill Reservoir. To help mitigate the impact of the winter drawdown, CVPS proposes to delay the onset of the winter drawdown until the beginning of January. Historically, it started as early as September.

90. **Sucker Brook - Goshen Dam to diversion dam.** A 1.8 acre emergent wetland is present directly upstream of the diversion dam and other wetlands exist along Sucker Brook but upstream of the influence of the diversion dam. The diversion dam wetland is occasionally flooded during high flow periods when the dam impounds water and the water level rises six feet before spilling over the dam; this typically occurs each year for 2 to 3 weeks during spring runoff and 2 or 3 times for a day or two as a result of heavy rainfall events (Response to AIR No. 2, *Additional Information Second Set, Silver Lake Project No. 11478*, CVPS, February 1996). The wetland is mapped on the National Wetland Inventory and is, therefore, a Class Two wetland under the Vermont Wetland Rules. CVPS's modified its original proposal, which would have resulted in permanent inundation of the wetland.

91. This wetland provides at least the following functions: surface water quality protection, erosion control through binding and stabilizing the soils, and wildlife and migratory bird habitat. The wetland is in good condition.

92. **Silver Lake.** No wetlands were identified in association with Silver Lake.

VIII. Rare and Endangered Species and Outstanding Natural Communities

93. The Vermont Endangered Species Law (10 V.S.A. §§5401 to 5403) governs activities related to the protection of endangered and threatened species.

94. Two federally listed threatened or endangered species are known to occur in the project area, those being occasional transient specimens of the endangered bald eagle (*Haliaeetus leucocephalus*) and Peregrine falcon (*Falco peregrinus anatum*). Peregrine falcons historically nested in the ledges east of Silver Lake, in an area just outside project boundaries. (Letter from Gordon E. Beckett, U.S. Fish and Wildlife Service to Tina L. Jones, Kleinschmidt Associates, August 29, 1991).

95. The Falls of Lana is the only waterfall or gorge in the state known to have the species *Potentilla tridentata*, the three-toothed cinquefoil. (*The Waterfalls, Cascades and Gorges of Vermont*, Jenkins and Zika, Vermont Agency of Natural Resources, 1985).

IX. Shoreline Erosion

96. In October 1994, Knight Consulting Engineers, Inc. and the applicant conducted a shoreline inspection of both Sugar Hill Reservoir and Silver Lake by boat. (Response to AIR No. 1, *Additional Information, Silver Lake Project No. 11478*, CVPS, February 1995).

97. Erosion was reported at the Sucker Brook entrance to Sugar Hill Reservoir, probably as a result of beaver activity, and at the boat launch/access road, which contained large gullies caused by surface erosion. No significant shoreline erosion problems were identified.

98. Silver Lake's western shoreline is mostly composed of exposed bedrock and boulders and cobbles, exhibiting no significant erosion problems. Along the eastern shoreline, four areas were noted as suffering from erosion, with at three of the areas experiencing erosion at least in part as a result of wave action during periods of high water.

99. At the beach area between the flume inlet and the dam at the northern end of Silver Lake, wave action causes erosion of the silty sand soils at the toe of a steep slope leading up to a grassed picnic area. Birch trees were found to be leaning nearly horizontally over the beach. The applicant's engineering consultant recommended lowering the maximum lake level three feet in order to reduce the erosion.

100. Consistent with the recommendation made by its consultant, the applicant has lowered the maximum operating level of Silver Lake to reduce shoreline erosion potential. The U.S. Forest Service, which manages the north end recreational area, had indicated that it would hire a consultant to address remediation needs and control of recreational access to reduce erosion caused by foot traffic; the status of this proposed action is unknown.

X. Recreational Use

101. The project area has a high value for recreation due to its fairly remote nature and its association with the Green Mountain National Forest. The project area is popular for many recreational uses, including angling, swimming, sunbathing, boating, picnicking, camping, photography, viewing and trail uses (hiking, horseback riding, bicycling, skiing and snowmobiling). In 1996, the applicant transferred approximately 1,210 acres surrounding and including Sugar Hill Reservoir to the U.S. Forest Service. Ownership was retained for 25 acres, including the dam, parking area, and access.

102. Within a 15-mile radius of the Silver Lake dam, both developed and primitive campsites are available in addition to the over 25 trails of various lengths and difficulty ratings maintained by the U.S. Forest Service. A primitive campground is maintained by the U.S. Forest Service at Silver Lake, consisting of 16 tent sites with picnic tables and fire rings. The Silver Lake area averaged a use of 6,360 recreationalists (1,040 campers) annually during the summers of 1990-93. The highest use month is October with 3,400 users.

103. At the northern end of Silver Lake, the U.S. Forest Service maintains a sand and gravel beach. The lake provides opportunities for canoeists to enjoy the undeveloped nature of the area.

104. The Silver Lake Recreational Area is zoned for non-vehicular use and is roughly 0.6 mile from the trail head at Green Mountain National Forest Road 27. The area can also be accessed by foot from Vermont Route 53 via the Silver Lake Trail, an approximately 1.6 mile hike. The trail leads to the Falls of Lana Picnic Area.

105. CVPS proposed several improvements at the project: upgrading the scenic overlook at the Falls of Lana in consultation with the U.S. Forest Service; improving the access road and boat ramp at Sugar Hill Reservoir, including directional signage; and installing interpretive signage throughout the Project area in consultation with the U.S. Forest Service.

XI. Aesthetics

106. The limited access, forested condition, and public land ownership enhance the aesthetic values of the project area. The three primary resources are Silver Lake, Sugar Hill Reservoir, and Sucker Brook. A particularly important and heavily used feature on Sucker Brook is the Falls of Lana. In the Agency study *The Waterfalls, Cascades and Gorges of Vermont* (Jenkins and Zika, Vermont Agency of Natural Resources, 1985), the Falls were rated of high importance due to their moderately wild and secluded character.

107. A special aesthetics flow study, including videotaping, was completed at the Falls of Lana, viewing flows of 3.1 cfs (0.24 csm) to 13.4 cfs (1.05 csm). (Response to AIR No. 10, February 1995)

XIII. State Comprehensive River Plans

108. The Agency, pursuant to 10 V.S.A. Chapter 49, is mandated to create plans and policies under which Vermont's water resources are managed and uses of these resources are defined. The Agency must, under Chapter 49 and general principles of administrative law, act consistently with these plans and policies whenever possible.

Hydropower in Vermont, An Assessment of Environmental Problems and Opportunities (May 1988)

109. The Department publication *Hydropower in Vermont, An Assessment of Environmental Problems and Opportunities* is a state comprehensive river plan. The hydropower study, which was initiated in 1982, indicated that hydroelectric development has a tremendous impact on Vermont streams. Artificial regulation of natural stream flows and the lack of adequate minimum flows at the sites were found to have reduced to a large extent the success of the state's initiatives to restore the beneficial values and uses for which the affected waters are managed.

110. With respect to Sugar Hill Reservoir, the study recommended further analysis of reservoir stratification and downstream effects, control of access road erosion, assessment of additional recreational needs, and collection of additional information on flow regulation. Control of drawdowns and establishment of minimum flows were recommended.

111. With respect to the diversion dam, the study recommended further analysis of downstream effects on fisheries. Establishment of minimum flows for recreational values and fish habitat was recommended.

112. With respect to Silver Lake, the study report indicated that there was an informal agreement between the applicant and the Forest Service that summer operating levels would not be dropped more than 4.5 feet below the spillway crest. The study recommended formalizing the agreement and establishing minimum flows below the tailrace.

1993 Vermont Recreation Plan

113. The 1993 Vermont Recreation Plan (Department of Forests, Parks and Recreation), through extensive public involvement, identified water resources and access as top priority issues. The planning process disclosed that recreational use of surface waters is increasing, resulting in greater concern about water quality, public access to Vermont's waters, and shoreland development.

114. The plan's Water Resources and Access Policy is:

    It is the policy of the State of Vermont to protect the quality of the rivers, streams, lakes, and ponds with scenic, recreational, cultural and natural values and to increase efforts and programs that strive to balance competing uses. It is also the policy of the State of Vermont to provide improved public access through the acquisition and development of sites that meet the needs for a variety of water-based recreational opportunities.

115. Enhancement of access and improved flow management would be compatible with this policy and balance the competing uses of recreation and hydropower. Failure to provide access would exacerbate a critical state recreational problem.

116. Another priority issue identified in the Recreation Plan is the loss or mismanagement of scenic resources. The plan notes "[t]he protection of the scenic and visual resources in Vermont is paramount if Vermont is to maintain its renowned charm and character."

117. The Scenic Resources Protection and Enhancement Policy in the Recreation Plan is:

    It is the policy of the State of Vermont to initiate and support programs that identify, enhance, plan for, and protect the scenic character and rural traditions of Vermont.

XIV. Analysis

Bodies of Water

Sugar Hill Reservoir

118. The proposed rule curve for operation of Sugar Hill Reservoir will substantially reduce annual fluctuations in water levels and should improve hibernacula by delaying the onset of the winter drawdown. Management for generation and guaranteed downstream conservation flows to Sucker Brook to improve aquatic habitat during the summer will continue to limit the

establishment of a littoral zone in the reservoir but will maintain the existing wetland in the southeast bay. More fish should be able to overwinter in the reservoir as the volume of the reservoir is not going to be as severely depleted.

Silver Lake

119. Stabilization of Silver Lake would present limited opportunities for littoral zone development. No wetlands were identified in association with this lake. Having continued relatively stable conditions during the recreational use period is important. During the period March 15 - May 31, the lake should be managed to maintain a stable or rising condition to protect spring spawning fish and prevent dewatering of eggs. In order to avoid drawing the reservoir in the spring, the applicant would have to carefully manage the smelt operating protocol such that the flow releases to protect smelt do not exceed inflows to the lake.

Water Chemistry

120. The release of oxygen-depleted water from Sugar Hill Reservoir is likely to continue since summer water levels and outflows will be similar to historic conditions. If this is confirmed by the applicant's proposed monitoring, a baffle system or other reaeration method can be implemented.

121. The relatively shallow intake at Silver Lake apparently does not create a hypolimnetic discharge. Dissolved oxygen levels below the powerhouse tailrace consistently met standards during the applicant's monitoring. The discharge does result in an increase in temperature relative to ambient upstream conditions in Sucker Brook. The tailrace discharge on July 25, 1991 raised the brook temperature from 18.4 deg C to 25.2 deg C. This was the worst case condition in the data set. It is not believed that occasional high temperatures on this order would affect support of coldwater fish. The impact will be slightly ameliorated by the new conservation flow to be released at the diversion dam. If a persistent problem is identified at any future point, the Department can reopen the federal license to address the issue.

Flow Needs in Stream Reaches

122. Conservation flows are needed both below Goshen Dam and below the diversion dam. Past operation of Goshen Dam provided a continuous minimum flow below the dam of 2.5 cfs, or 0.96 csm. The proposed operating rule would reinstitute the 2.5 cfs conservation flow year around. If inflows decline below these flows, storage will be used to augment flows. During the summer period, the three feet of storage below the normal five-foot operating range will be dedicated to providing for the conservation flow guarantee. Only when the reservoir reaches the bottom of the dedicated storage will the augmentation cease and inflows will be matched to stabilize the reservoir until flows increase. Information on summer water levels and the effect of the guaranteed flow on drawdowns is limited to the year 1989. Data collected after license issuance can be used to evaluate how often the three feet of dedicated storage is depleted. If the depletion is frequent, the benefits of reducing the conservation flow should be assessed, as it would reduce or eliminate the need to reduce dam releases to the reservoir inflow rate and help sustain a fixed release of 2.5 cfs below the diversion dam.

123. Based on the stream hydrology and the results of the habitat study below the diversion dam, a conservation flow of 2.5 cfs, or 0.26 csm, is appropriate for the reach directly downstream of the diversion dam. This represents a substantial improvement over previous conditions, which dedicated no flows to this reach below the diversion dam. Normally this flow will be assured by the guaranteed flow release from Sugar Hill Reservoir. During low flow periods when storage has been depleted at Sugar Hill Reservoir and CVPS is releasing reservoir inflows only, the 2.5 cfs will still generally be available from the reservoir release and the flow contribution from the intervening seven square mile watershed, which includes a major tributary, Dutton Brook.

124. To protect smelt spawning below the tailrace, CVPS should continue operation under its special protocol and provide the Department with its related monitoring records (brook water levels, generation schedule, smelt observations (start and end of spawning and date when hatching is complete), Silver Lake water levels, water temperature data, descriptive characterization of the hydrologic conditions, and problems encountered).

Ramping

125. Ramping is necessary at both Goshen Dam and below the project tailrace due to the large artificial flow fluctuations.

Screening

126. The existing screen at the lower end of the powerhouse tailrace should be maintained to prevent fish from ending the tailrace during generation and subsequently becoming stranded when the plant shuts down.

127. The bar spacing on the trashrack at Sugar Hill Reservoir is sufficient to prevent significant losses of fish from the reservoir. However, the spacing at Silver Lake may allow some losses. The bar spacing should be reduced when the current trashracks are replaced.

Recreation

128. Vermont Water Quality Standards require the protection of existing water uses, including the use of water for recreation. Standards also requires the management of the waters of the State to protect, maintain, and improve water quality. (Standards Section 1-03 *Anti-Degradation Policy*)

129. Uses for which Class B waters are managed include water that exhibits good aesthetic value and swimming and recreation. (Standards Section 3-04(A) *Class B Waters: Management Objectives*)

130. Changes in reservoir management and provision of minimum flow releases will improve the sports fishery and reduce or eliminate the present impairment of angling use.

131. Boating conditions in Sugar Hill Reservoir will remain similar to current conditions. The delay of the winter drawdown will improve boating in the fall.

132. The applicant is will be maintaining existing recreation facilities and providing for future recreational use through its master recreation plan. The U.S. Forest Service will continue to manage the lands at the project for recreation, including primitive camping. The designated uses of swimming and recreation will be supported.

Erosion

133. The applicant identified minor erosional areas associated with reservoir recreational use. Erosion, if severe, can impair recreational use and cause turbidity and the discharge of suspended solids, potentially violating the standards for those parameters (Standards Section 3-03(B)(1) *Turbidity*; Standards Section 3-01(B)(5) *Settleable solids, floating solids, oil, grease, scum, or total suspended solids*). This certification is being conditioned on remediation of any significant erosion problems when identified by the Department.

Debris

134. The applicant does not provide information on the handling and disposal of trashrack debris and other project related debris. The depositing or emission of debris and other solids to state waters violates the state solid waste laws and Standards, Section 3-01(B)(5) *Settleable solids, floating solids, oil, grease, scum, or total suspended solids*. A plan is being required as a condition of this certification.

Decision and Certification

Based on its review of the applicant's proposal and the above findings, the Department concludes that there is reasonable assurance that operation and maintenance of the Silver Lake Hydroelectric Project as proposed by the applicant and in accordance with the following conditions will not cause a violation of Vermont Water Quality Standards and will be in compliance with sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act, 33 U.S.C. §1251 et seq., as amended, and other appropriate requirements of state law:

A. **Compliance with Conditions.** The applicant shall operate and maintain this project consistent with the findings and conditions of this certification, where those findings and conditions relate to protection of water quality and support of designated and existing uses under Vermont Water Quality Standards and other appropriate requirements of state law.

B. **Reservoir and Flow Management.** The Project shall be operated in accordance with the minimum flow and reservoir level management schedules tabulated below. Minimum flows shall be released on a continuous basis and not interrupted.

Table 1a. Sugar Hill Reservoir Late Spring/Summer/Fall/Early Winter Operating Rule from May 1 through December 31

Reservoir Level (feet msl)		Flow management
Elevation	Relative	
>1765.5	Above 0	Release at a rate as necessary to bring the reservoir down to 1765.5; maintain no less that 2.5 cfs at all times
1760.5 – 1765.5	0 to -5.0	Release no less than 2.5 cfs
1757.5 – 1760.5 (storage dedicated to providing conservation flow)	-5.0 to -8.0	Fixed release of 2.5 cfs
1757.5 (maximum allowed drawdown)	-8.0	Match inflow
Note: Based on a review of drawdown and flow release data, the Department may lower the 2.5 cfs conservation flow for this period if doing so would improve the overall flow regime for aquatic biota below Goshen Dam and below the diversion dam by reducing or eliminating the frequency and duration of drawdowns to elevation 1757.5 feet msl and the corresponding lower outflows from the reservoir. Any consideration of a lower conservation flow shall be done in consultation with the Department of Fish and Wildlife, the U.S. Fish and Wildlife Service, the U.S. Forest Service, and CVPS.		

Table 1b. Sugar Hill Reservoir Late Winter/Early Spring Operating Rule from January 1 through April 30

Reservoir Level (feet)		Flow management
Elevation	Relative	
>1760.5	Above -5.0	Maintain at no less than 2.5 cfs
1747.5 – 1760.5 (1747.5 maximum allowed drawdown)	-18.0 to -5.0	Maintain at no less than 2.5 cfs and manage drawdown in a manner that sufficient storage is available to accomplish this without dropping below elevation 1747.5 feet
Note: Winter drawdown begins on or about January 1 from the target elevation of 1765.5 feet msl (assuming that elevation can be attained from fall inflows while maintaining the 2.5 cfs conservation flow downstream), or after headpond ice formation, if later.		

Table 2. Sucker Brook Diversion Management Requirements

Period	Bypass Minimum Flow Release (cfs)
Year around	2.5
Note: Minimum flows is the value listed, or instantaneous inflow, if less.	

Table 3. Silver Lake Water Level Management

Summer/fall operating range (June - November)	1245.5-1247.5 feet msl
Winter/spring maximum drawdown (December - May)	1239.5 feet msl
March 15 - May 31 water level mgmt.	rising or stable

C. **Ramping plan at Goshen Dam.** The applicant shall develop a ramping plan for the adjustment of the valve system at Goshen Dam in order to control the rate of change of downstream flows and protect downstream aquatic organisms. The plan shall cover both up ramping and down ramping. The plan shall be developed in consultation with the Department, the Vermont Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service and shall be subject to Department approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

D. **Ramping plan at Station Tailrace.** The applicant shall develop a down-ramping plan to govern reductions in the station discharge in order to prevent stranding and mortality to

downstream aquatic organisms. The plan shall be developed in consultation with the Department, the Vermont Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service and shall be subject to Department approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

E. **Smelt Spawning Protection Operating Protocol.** The applicant shall revise its 1998 written operating protocol to include: 1) monitoring to commence on or before March 15; 2) reduced or no generation to start no later than official sunset and end no earlier than official sunrise; and 3) installation of water level and water temperature dataloggers in the principal smelt spawning area and continuous data collection starting March 15 and ending when hatch is complete. A comprehensive data report and narrative review shall be filed each year with the Department and the Department of Fish and Wildlife on or before August 1 following the season. The report shall include brook water levels, generation schedule (tailrace flows), smelt observations (start and end of spawning and date when hatching is complete), Silver Lake water levels, water temperature data, a descriptive characterization of the hydrologic conditions, and any problems encountered. The report shall include data graphs, and the data shall be provided as an electronic spreadsheet file. The Department, based on a request from the Department of Fish and Wildlife, may require changes to the protocol. The applicant may also request changes, which the Department will consider and act upon after consultation with the Department of Fish and Wildlife.

F. **Plan for method to maintain conservation flows below Sucker Brook diversion dam.** The applicant shall develop a plan, including descriptions, hydraulic design calculations, an implementation schedule, and design drawings for the measures to be used to release the bypass flows at the Sucker Brook diversion dam. The plan shall be developed in consultation with the Department and the U.S. Fish and Wildlife Service and shall be subject to Department approval. Said approval may be conditional on field verification of the flow releases. The Department reserves the right of review and approval of any material changes made to the plan at any time.

G. **Operating plan for Sugar Hill Reservoir.** The applicant shall develop an operating plan for Sugar Hill Reservoir, indicating how the dam shall be operated to conform to the goals of the operating rules contained in Condition B. The filing shall include performance expectations for the method and equipment to be used and a supporting calculation brief; this would include consideration of how frequently adjustments to the valve system must be made to meet the goals under different background conditions. The plan shall be developed in consultation with the Department and the U.S. Fish and Wildlife Service and shall be subject to Department approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

H. **Monitoring Plan for Reservoir and Flow Management.** The applicant shall develop a plan for continuous monitoring of flow releases at the project, both below the dams and below the station tailrace, and reservoir levels and inflows. The valves at Goshen Dam shall be rated using field testing over the range of reservoir operating levels; the results and methodology used shall be included in the plan. The applicant shall maintain continuous records of flows and reservoir levels and provide such records on a regular basis as per specifications of the Department. The plan shall be developed in consultation with the Department and the U.S. Fish

and Wildlife Service and shall be subject to Department approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

I. **Maintenance of Dissolved Oxygen Standards below Goshen Dam.** During the first full season of operation after license issuance, dissolved oxygen and temperature conditions shall be monitored weekly from July through September directly below the Goshen Dam outlet when a dissolved oxygen profile in the reservoir near the outlet discloses stratified conditions. The applicant shall collect dissolved oxygen and temperature data at Stations a, a-1, a-2, and a-3 (ref. 1992 water quality study) and a dissolved oxygen/temperature profile at a reservoir sampling station near the outlet. Records shall include the reservoir elevation and the downstream flow release at the time of sampling. If samples at Station a are found to be substandard, the proposed baffle system shall be installed and tested to determine if it will assure maintenance of standards. A quality assurance/quality control plan shall be filed with the Department prior to initiating such a study. By December 1 following the sampling period, the applicant shall file a report of its findings and data. The Department may require additional investigation or remedial measures based on the study results.

J. **Fish Exclusion from Station Tailrace.** The applicant shall continue to maintain a device at the lower end of the station tailrace to prevent fish from ascending the tailrace and becoming stranded. Any proposal to modify the design shall be subject to Department approval.

K. **Silver Lake Trashrack.** When the trashrack at Silver Lake is replaced, the new rack shall be designed with a 1.5-inch or narrower bar clear spacing.

L. **Turbine Rating Curves.** The applicant shall provide the Department with a copy of the turbine rating curves, accurately depicting the flow/production relationship, for the record within one year of the issuance of the license.

M. **Debris Disposal Plan.** The applicant shall develop a plan for proper disposal of debris associated with project operation, including trashrack debris. The plan shall be developed in consultation with the Department. After Department approval of the plan, the plan shall be filed with FERC no later than 120 days from the date of license issuance. FERC shall either approve the plan or return the plan to the applicant for revision to incorporate FERC-recommended changes. After revision, the applicant shall submit the plan to the Department for approval of the changes. The plan shall then be filed with FERC for final approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.

N. **Maintenance and Repair Work.** Any proposals for project maintenance or repair work involving the brook, Sugar Hill Reservoir, or Silver Lake, including desilting, drawdowns to facilitate repair/maintenance work, and tailrace dredging, shall be filed with the Department for prior review and approval, if said work may adversely affect water quality or cause less-than-full support of designated and existing uses of State waters.

O. **Public Access.** The applicant shall allow public access to the project area for utilization of public resources, subject to reasonable safety and liability limitations. Such access should be prominently and permanently posted so that its availability is made known to the public. Any proposed limitations of access to State waters to be imposed by the applicant shall first be subject to written approval by the Department. In cases where an immediate threat to public

safety exists, access may be restricted without prior approval; the applicant shall so notify the Department and shall file a request for approval, if the restriction is to be permanent or long term, within 14 days of the restriction of access.

P. **Recreational Facilities.** Recreational facilities shall be constructed and maintained consistent with the proposed recreation plan. Prior to construction at individual facilities, final design plans and details shall be filed with the Department for review and comment. The applicant is advised to consult with the Department and the U.S. Forest Service in the development of plans. Where appropriate, filings shall include an erosion control plan that will be subject to Department approval prior to commencement of construction.

Q. **Erosion Control.** Upon a written request by the Department, the applicant shall design and implement erosion control measures as necessary to address erosion occurring as a result of use of project recreational facilities. Any work that exceeds minor maintenance shall be subject to prior approval by the Department and FERC.

R. **Restoration Fund.** The applicant shall contribute $250,000 to a fund (Fund) to be known as the Lake Champlain and Tributaries Restoration Fund, which shall be created by the State of Vermont and administered by an independent non-profit community foundation (the Fund Trustee) chosen by the applicant and the Vermont Agency of Natural Resources. The Fund, which shall include the contribution and associated earnings as well as outside monies contributed by others and associated earnings, is to only be used for eligible projects, the purpose of which are to:

a) Protect, restore and enhance the ecosystem integrity and ecological connectivity of the community of aquatic life in the Lake Champlain ecosystem and its tributaries.

b) Protect, restore and enhance lake sturgeon and their habitats in the Lake Champlain basin and its tributaries.

c) Restore a self-sustaining land-locked Atlantic salmon population in Lake Champlain through habitat restoration and fish monitoring programs.

d) Protect the riparian zones along Lake Champlain tributaries for the benefit of the ecological and recreational resources, through the purchase of land or easements.

The Fund shall not be used for projects located outside of the Lake Champlain basin, or on New York tributaries of Lake Champlain. The applicant shall make a nonrefundable contribution in the amount of $250,000 within 30 days of the completion of the following two events: (a) issuance of this certification or if this certification is the subject of an appeal, upon the completion of the appeal process provided that the certification contains conditions that are materially similar to this original certification and (b) issuance of a FERC license that contains conditions of this certification, or a certification issued on appeal with materially similar conditions, or if the FERC license is the subject of an appeal, upon the completion of the appeal process provided that the FERC license contains conditions that are materially similar to the final certification.

The Fund Trustee shall make investment decisions, and shall disburse monies from the Fund from time to time, in whole or in part, based upon recommendations made by representatives of the CVPS, the ANR, the U.S. Fish and Wildlife Service, the Vermont Natural Resources Council and Trout Unlimited who shall serve as the Fund Advisors. The Fund Advisors shall make decisions based upon vote of a majority of the Fund Advisors (not simply a quorum thereof). Any party may permanently withdraw as a Fund Advisor upon written notice to the other Fund Advisors. The Fund Advisors may solicit proposals from nonprofit organizations, educational institutions, units of government, and officially appointed commissions, boards or other entities within the state of Vermont for projects which address any of the above purposes. The Fund Advisors may target a specified portion of the funds to specific protection, mitigation, or enhancement objectives or to specific areas which are encompassed within the purposes and geographic scope defined above.

The Fund Trustee shall only disburse monies from the Fund when matching funds are contributed to a project by Parties or entities other than CVPS, at a ratio of no less than $1 of outside monies for every $2 drawn from CVPS's contribution and Fund earnings thereon.

S. **Compliance Inspection by Department.** The applicant shall allow the Department to inspect the project area at any time to monitor compliance with certification conditions.

T. **Approval of Project Changes.** Any change to the project that would have a significant or material effect on the findings, conclusions, or conditions of this certification, including project operation, must be submitted to the Department for prior review and written approval where appropriate and authorized by law and only as related to the change proposed.

U. **Reopening of License.** The Department may request, at any time, that FERC reopen the license to consider modifications to the license as necessary to assure compliance with Vermont Water Quality Standards.

V. **Continuing Jurisdiction.** The Department reserves the right to add and alter the terms and conditions of this certification, when authorized by law and as appropriate to carry out its responsibilities during the life of the project with respect to water quality.

Dated at Waterbury, Vermont this
5th day of December, 2008

Laura Q. Pelosi, Commissioner
Department of Environmental Conservation

By 

Larry R. Fitch, Director
Facilities Engineering Division

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